B-*field Mapping of a Magneto-Gravitational Neutron Bottle with a Robotic Manipulator*

Keegan Hoffman

TTU, Physics

The UCNτ collaboration has the ultimate goal of measuring the free neutron lifetime to within 0.01%, or to an error of about ±0.1s. A trap composed of a bowl-shaped Halbach array of permanent magnets inside of a vacuum jacket that is wrapped by field coils is used to contain polarized, ultracold neutrons (UCN), which are allowed to decay inside the trap. The magnetic array, in conjunction with gravity, keeps the UCN from escaping while the field coils prevent the UCN from depolarizing. Due to physical imperfections in the array, it is possible that there are regions near the surface where the magnetic fields are insufficient to repel trapped UCN. There might also be regions where the magnetic fields from the array and the coils destructively interfere, which could lead to depolarization. Both of these would allow neutrons to escape the trap, introducing a systematic error. We have constructed a robotic arm to move a three-axis Hall probe through the entire volume of the trap to check for these weak-field regions. I will describe results from a first test run of this apparatus conducted at Los Alamos National Lab over the summer.